



Microlearning for Today's Students: A Rapid Review of Essentials and Considerations

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Abstract

The concept of microlearning is based on Hermann Ebbinghaus' forgetting curve, which states that when people take in large amounts of information, retention of the learned information tends to degrade over time. Microlearning can be used to deal with this issue. Splitting the content into small pieces and recalling the different pieces over time can improve knowledge retention and productivity. Small learning steps, with small portions of information, can be used for learning in between and on-demand. The learner is in control of what and when they learn. In this way, microlearning enables learners to stay up-to-date in today's knowledge society. Microlearning is an engaging educational approach to learning new skills and information in small parts at a time.

Online content, including video tutorials, audio podcasts, presentations, scenarios, and assessments, can be presented as microlearning. Microlearning is not much different from traditional lessons. Rather, microlearning involves condensing and optimizing traditional lessons for delivery in a short time. This educational method is a learner-centered approach that provides just-in-time training on multiple devices (tablets and smartphones besides desktops and laptops). It should be noted that microlearning might not be suitable for more complex topics. Though microlearning is an effective learning strategy for reinforcement and retention, it cannot be used to provide basic and deep knowledge and complex concepts. Smart learning is not suitable for learning analytical skills or discovering cause and effect relationships, as these activities usually require time for planning and reflection.

Key Words: Advantages, Disadvantages, Learning, Microlearning, Students.

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1- INTRODUCTION

In today's world, people face a shortage of time more than ever before. The emergence of various concerns has limited the possibility of long-term focus. In this situation, the best way to improve the educational system is to use a method that provides the most information in the shortest possible time. In addition, learners should be able to access educational content from any place and on any device (1). Electronic learning has become a global trend in recent years, particularly after the worldwide spread of COVID-19. Traffic restrictions in cities and the limited possibility of face-to-face learning have led people to seek an effective way to use online platforms for learning (2-5).

Educational design is one of the most important topics in the education industry in 2022 (6). As more and more institutions become involved in e-learning, choosing the right method of content delivery becomes more important. Educational institutes should pay special attention to the quality of educational content and its presentation method. The effective instructional design places the learner at the center and focuses on providing high-quality, personalized, intuitive, fun, and innovative experiences based on user needs (6-8).

The increase in demand for creating a new educational method has led to the implementation of new trends in online education and online education management systems. One of the most effective solutions available is microlearning. It is a practical and effective way of transferring information faster and easier. Microlearning is a type of education where electronic educational concepts are provided to the general public in the simplest possible way and in a smaller size. In this case, the educational content is presented as understandable for learners and provides the essential learning points as simply as possible to the learners

(9-12). The organizers of microlearning courses divide an educational topic into short parts and allow the learner to consider a part of the training for learning at the desired time and according to their preference (12-15). This study aimed to identify the principles, impacts, and challenges of microlearning research in higher education.

2- MATERIALS AND METHODS

2-1. Data sources

In this review study, a systemic search of electronic databases Medline (via PubMed), Scopus, Web of Science, EMBASE, Cochrane Library, ERIC, ProQuest Dissertations, CIVILICA, and Google Scholar search engine was performed with no time limit up to October 2022. The following keywords were used alone or in combination: "Microlearning, Microteaching, Microlecture, Electronic learning, Just-in-time learning, and Just-in-time training". The studies were written in English or Persian. The search was done independently and in duplication by two reviewers, and any disagreement between the reviews was resolved by the supervisor.

2-2. Inclusion criteria

Inclusion criteria were all qualitative and survey (observational) data, cross-sectional, experimental, prospective, review and systematic review, thesis, and cohort study designs in English or Persian.

2-3. Study selection

Database search was done for suitable studies, abstracts of the studies were screened for identification of eligible studies, full-text articles were obtained and assessed, and a final list of eligible studies was made. This process was done independently and in duplication by two reviewers, and any disagreement was resolved by a third reviewer. References

were organized and managed using EndNote software (version X8).

3- RESULTS

The world used to be a place without computers, the Internet, and mobile phones, and people had no access to information buried in stacks of paper. Technology and inventions have paved the way for microlearning (16-18). Today, virtually everyone has a smartphone, and many people spend a great deal of time commuting to work or university to learn. This makes microlearning suitable in the world of rapidly advancing technology. Microlearning is a modern approach to learning based on short and concise training with practical results for learners when they need it (18-20).

3-1. Definition

Microlearning (the Greek word "micro" meaning small) has been translated into various terms, including micro-education, micro training, micro-course, micro-lessons, and partial learning, all referring to the same concept (20, 21). Microlearning uses short and small pieces of information to achieve a specific learning outcome. There

is no definitive time requirement for microlearning, but typically the content takes the learner one to ten minutes (22). Microlearning is offered in small units designed to help learners learn a large amount of educational content in the form of small pieces and in a short duration. Microlearning training units last from one to ten minutes and are made to teach a specific scientific and educational subject. It is one of the most creative ways of education, making the learning process entertaining and reducing the difficulty and monotony of the material (20, 22). The research results showed that the best duration for training pieces is ten minutes, and units of two to five minutes are the most effective in microlearning (22-25).

3-2. Other names

Microlearning has several nicknames such as Micro-eLearning, Chunks, Micromedia, Bites Bite-sized learning, and Micro-content (**Figure 1**) (22).

3-3. A Micro-history of Microlearning

Microlearning has a 200-year history, summarized in **Figure 2** (20, 22):



Fig.1: Synonyms of microlearning (22).

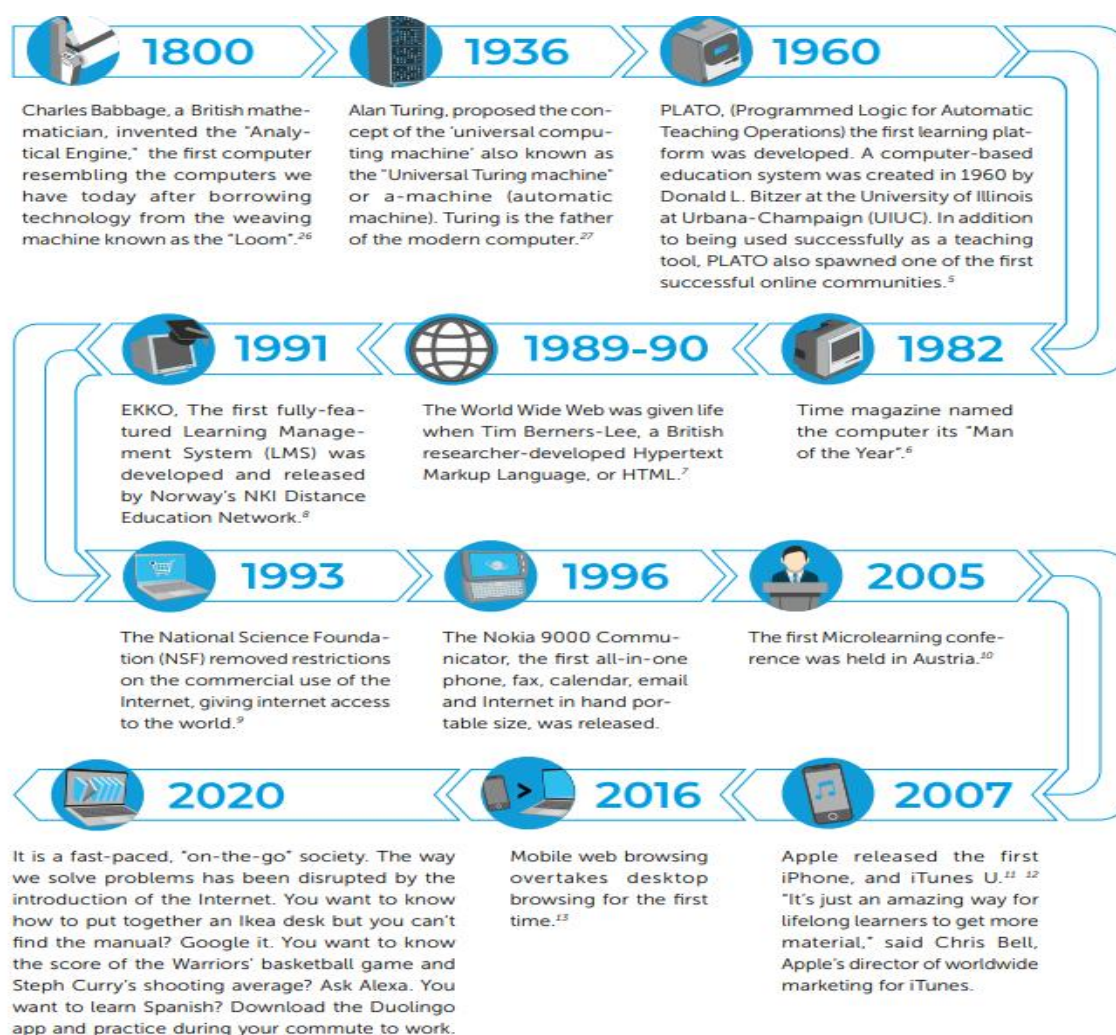


Fig.2: The history of microlearning (20, 22).

3-4. Difference between Microlearning and Macrolearning

Microlearning vs. macrolearning is the oldest debate in the industry. Although microlearning has been shown to outperform macrolearning, it should be noted that both methods are beneficial in their way. Macrolearning is a formal learning intervention and a self-contained learning event that teaches one subject area. Micro- and macrolearning can be regarded as mutually exclusive, as what is micro is not macro and vice versa. Some differences between microlearning and macrolearning are shown in **Table 1** (22).

3-5. Microlearning theory

The concept of microlearning is based on Hermann Ebbinghaus' forgetting curve. In the mid-1880s, Hermann Ebbinghaus developed a scientific approach to studying and classifying memory and introduced concepts of learning and forgetting curves. According to Ebbinghaus, people typically lose 80% of what they learn within a month. This is known as the Forgetting Curve (**Figure 3**). When people learn large amounts of information, they only keep that information in their memory for a certain

period. If this information is not "important" for routine tasks, it fades from the mind over time. Breaking down the content into small pieces and recalling the different parts over time can improve knowledge retention and productivity. According to Ebbinghaus' Memory Retention curve, when someone learns something, they initially retain all of the

information, but as time passes, memory retention begins to decline. However, if the information is reviewed, it remains in the mind for a longer time. In microlearning, the educational content is divided into small parts (capsules) to engrain it in the mind. This can be done by presenting small modules with videos lasting only a few minutes (26-28).

Table-1: Some differences between microlearning and macrolearning (22).

	Macrolearning	Microlearning
What does the prefix mean?	Large, long, over time, large scale.	Small, short, minute in scale.
What is it?	Developing a new skill and level of understanding.	Exploring concepts and solving practical problems.
What is the desired outcome from learning?	The learner wants a new skill or deeper understanding of a concept.	The learner wants to solve a specific problem.
What is the content like?	<ul style="list-style-type: none"> ▪ Large modules ▪ Elements of formal learning ▪ Complex issues ▪ Learning arranged over time. 	<ul style="list-style-type: none"> ▪ Small nuggets of information ▪ Elements of informal learning ▪ Simple issues ▪ Learning just-in-time on-the-job.
What is it important in the workplace?	Understanding the job, people, systems, strategies, industry, and environment.	Injections of new information at all career stages to solve various problems faced every day.
How long does it take?	Hours-days	1 second- 15 minutes
Examples	<ul style="list-style-type: none"> ▪ Course, classes, MOOCs ▪ I want to learn Photoshop ▪ Course textbooks ▪ I took a course in Spanish and studied abroad and I am now fluent. 	<ul style="list-style-type: none"> ▪ Video, blog, instructions ▪ I want to crop an image ▪ I learned how to ask, where is the bathroom? in Spanish ▪ Snapple fact.

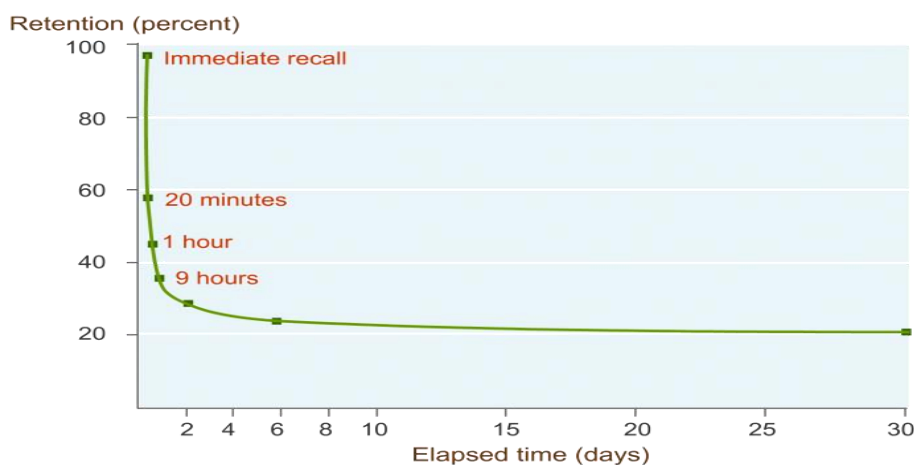


Fig.3: Ebbinghaus' Forgetting Curve (26).

The forgetting curve hypothesizes the decline of memory retention in time. This curve shows how information is lost over time when there is no attempt to retain it.

3-6. Dimensions

Microlearning activities consist of the following dimensions:

- **Time:** Relatively little effort, operating expense, degree of time consumption, measurable time, subjective time, among others.
- **Content:** Small or very small units, narrow topics, and simpler issues.
- **Curriculum:** Small part of curricular settings, parts of modules, and elements of informal learning.
- **Form:** Fragments, facets, episodes, "knowledge nuggets", skill elements, among others.
- **Process:** Separate, concomitant or actual, situated or integrated activities, iterative method, attention management, awareness (getting into or being in a process), among others.
- **Mediality:** Print media, electronic media, mono-media vs. multi-media, (inter-) mediated forms, among others.
- **Learning type:** Repetitive, activist, reflective, pragmatist, conceptualist, constructivist, connectivist, and behaviorist; action learning, classroom learning, and corporate learning, among others (9, 10, 20, 22).

3-7. Principles of microlearning

Features of the microlearning educational method make it an ideal strategy. Examples of these features are provided below:

3-7-1. Achieving an educational goal in each subject

While e-learning (online) courses deal with multiple learning objectives, microlearning involves a single performance objective per learning unit.

This ensures the learners' gradual progress and full understanding of the topic before moving on.

3-7-2. Providing targeted information

Each educational program contains two types of information:

- Mandatory information.
- Information that is recommended to learn.

While eLearning covers both, microlearning mostly focuses on mandatory information. This saves a significant amount of time and makes micro-education units more specific with more targeted information. This process removes the ambiguities about the essentiality of the information and provides the necessary information only.

3-7-3. Providing information in short durations for attention and learning

Micro-training, in the form of video, podcast, interactive PDF, and infographics with one executive goal in each training unit and targeted information, is structured so that recipients do not need more than eight to ten minutes to complete a unit. This characteristic of microlearning makes it desirable for the busy people of today with short attention spans and tight schedules.

3-7-4. Accessibility on all mobile devices

A computer is not always necessary to access microlearning units. Microlearning units are usually designed to be accessible through any mobile device, including smartphones, tablets, notebooks, and iPads. In addition, the short duration of the units makes them suitable for mobile access.

3-7-5. Presentation in various formats

Microlearning is not necessarily presented in common e-learning platforms. It can be

in the form of independent learning units in any format, including short videos, infographics, podcasts, short questionnaires, scenarios, motion graphics, interactive PDFs, or games. This variety eliminates the uniformity in training programs and increases the interest of trainees.

3-7-6. Applicability in different stages of training

An advantage of microlearning is that it can be used as an independent training mechanism or in combination with the main training strategy at any stage of the training and learning cycle.

The training cycle consists of the following three stages. Microlearning can be used in all three stages, separately or in combination.

- Providing a pre-test before the main training program to measure the previous knowledge of the trainees or to inform them on what they can expect from the course (pre-training).
- Providing more resources, examples, and activities during the training period.
- Strengthening and consolidating knowledge after the training course (after training).

3-7-7. The flexibility of microlearning

Microlearning can be delivered alone or as part of a larger learning resource. Microlearning sections can be independent and without the need for other educational units to understand the subject. They can also support regular training and add interactions to one-way communication (22, 29-31).

3-8. The Benefits of microlearning:

3-8-1. Requires less time to consume the content

3-8-2. Increases learners' engagement

Even people with great attention spans might struggle to remain engaged in long learning sessions. However, when people know that their learning or training session takes only a few minutes, they find it much easier to remain focused.

3-8-3. Improves knowledge retention

As researchers have noted, knowledge is more likely to be retained when it is recalled repeatedly. Microlearning facilitates self-directed lifelong learning, as short sessions can be easily integrated into everyday activities. Small learning steps with small pieces of information can facilitate learning on-demand. In this way, microlearning enables individuals to stay up-to-date in today's society. Small doses of information to review the learned material reinforce knowledge and aid memory.

3-8-4. Enables learning on the go (mobile learning)

As microlearning relies on small, bite-sized training sessions, it is easily accessible on any device, not just computers. Microlearning works with mobile learning to make learn-on-the-go possible. Its short, bite-sized lessons are easy to fit into a busy schedule. Learn (nearly) anywhere, any time.

3-8-5. Supports self-paced learning

People learn differently, and microlearning allows people to find a way of learning that works for them. They do not need to conform to a rigid, pre-structured course and can find a flexible solution in microlearning. Learners can learn at their own pace, whether it is a subject they excel at or one they need more time to master.

3-8-6. Enables personalized learning

Traditional training courses can be difficult to get through because they often contain information that is not specifically relevant to a learner's role.

3-8-7. Flexibility: Microlearning can cover any educational topic.

3-8-8. Easy reminder: Because the parts in microlearning are small, independent, and easy to return to, the learning material is easily remembered and retained in mind.

3-8-9. Universal freedom of action: Whenever a learner has free time, they can study repeatedly without restriction.

3-8-10. Long periods: It is suitable for long periods.

3-8-11. The possibility of updating: It is possible to update the existing content.

3-8-12. Less fatigue: Learning in chunks can be interesting, enjoyable, and not boring. It can even stimulate learners' curiosity for the next part of the training.

3-8-13. Reduces costs

Printing training materials, course booklets, and other resources can be expensive. Micro-education helps reduce the costs associated with delivering the content to students. Also, the need for physical space is not felt when using a microlearning approach.

3-8-14. Promotes peer-to-peer learning

Information is generally easier to share with other people when presented online. This way, microlearning can promote peer-to-peer learning and allow learners to share their courses and new information with their colleagues.

3-8-15. Learner-centric

Microlearning nuggets appeal to learners as they empower them and provides better self-directed control in assuming a personalized and flexible learning path. The varied formats used to create these nuggets are more likely to match individual learning styles.

3-8-16. Just-in-time

This is probably the biggest benefit for the learners. Microlearning nuggets are

available just when they require them to learn. They are also available on demand.

3-8-17. Rich media

Microlearning is designed in rich media formats that improve the retention of knowledge.

3-8-18. Accessibility

Microlearning can be designed for multi-device delivery (from desktops and laptops to tablets and smartphones), providing higher flexibility to learning at the time and on the device of the learners' choice.

3-8-19. Learning culture support

Learning culture is a set of organizational values and practices that encourage the ongoing development of professional knowledge and skills. Regular engagement with learning content is a sign of a strong learning culture. Microlearning is designed to be accessible on demand and easy to share, making it ideal for promoting a culture of learning.

3-8-20. Boosting learning efficiency

The compact structure of micro-courses enables learners to learn quickly and return to the workflow, ready to apply their knowledge to tasks. Microlearning focuses on one topic at a time, so learners gain specific knowledge in the most efficient way (20, 22, 32-46).

3-9. Challenges of microlearning

3-9-1. Time

The #1 obstacle that learners face in learning is the lack of time. Despite shorter learning modules of microlearning, people may still lack time to fit in a few minutes of learning in a day. This could also indicate that learners lack time to search for relevant learning.

3-9-2. Scaling personalized content

Personalizing millions of pieces of content to be relevant to each individual can be extremely tedious.

3-9-3. Difficulty in managing so much content

Microlearning is fragmented into smaller, singular topics. This poses the risk that some learners will not achieve the necessary depth of understanding. Moreover, consuming too many topics makes it difficult for learners to manage them.

3-9-4. Updating content

Educational content becomes out-of-date and irrelevant rapidly. Higher volumes of content are more difficult to manage.

3-9-5. Can become fragmented

As content is broken up into smaller chunks, there is the risk of fragmented learning. Without proper structure, learners may find problems following along and connecting the topics. Some learners might struggle to see the bigger picture and how each micro-course fits into it. This can lead to confusion and reduced motivation.

3-9-6. Accessibility problem

Splitting a large course into short microlearning chunks is not easy, but it is even more difficult to make it accessible for people with disabilities. It is challenging for instructional designers and requires specific knowledge and technologies. Designers must ensure that courses are formatted and optimized according to accessibility standards and practices. In addition, lack of digital literacy is among the biggest challenges for the digitally disadvantaged in accessing and understanding microlearning content.

3-9-7. Not ideal for in-depth training.

Microlearning may not be the best option for presenting in-depth educational material. This is the case when more than seven minutes are required to get general concepts across. Some concepts are so in-depth or require so much exploration that a course designed through micro-lessons cannot handle.

3-9-8. Combining elements to get one big picture

Microlearning does not allow learners to walk away, as different concepts combine to create a big idea. More in-depth learning options are needed for this type of content. It is necessary to find out if more sessions are needed before jumping on a microlearning course.

3-9-9. Creating a culture of learning

Motivating individuals with different aspirations is not easy. Creating a culture of learning and personalizing motivation is a difficult task (9, 10, 13, 20, 22, 47-50).

3-9-10. The Future of Microlearning

Microlearning is driven towards finding ways to meet the learner in their moment of need. With the continued progress of adaptive learning, adaptive learning, and the methods to further personalize learning, learning can be delivered before the learner realizes they need it. It is possible that in the future, organizations and individuals alike will strive to learn more effectively to complete tasks and solve problems (20, 22).

4- CONCLUSION

Microlearning is an educational strategy that breaks complex topics into short, stand-alone study units that can be viewed as many times as necessary, whenever and wherever the learner needs. Microlearning instructional modules are designed to be consumed in one to ten minutes and address one specific skill or knowledge topic. This educational method, designed typically in rich media formats, is a learner-centric approach that provides just-in-time training available on various devices (extending to tablets and smartphones besides desktops and laptops). All these aspects ensure its easy accessibility and fast completion and application by learners. Microlearning facilitates self-directed lifelong learning,

as short sessions can be easily integrated into everyday activities. Small learning steps with small chunks of information can be used for learning in between and on-demand. In this way, microlearning enables individuals to stay up-to-date in today's society. Small pieces of information to review the learned material reinforce knowledge and memory. Microlearning is generally less expensive to develop and maintain, contributing to a higher return on investment.

Though microlearning is an effective strategy for reinforcement and retention of knowledge, it is inefficient for learners who need mastery over a broad topic in a short period or to acquire knowledge about a concept that cannot be broken down easily. In this type of learning, the microlearning approach might even be harmful, especially if the learner lacks the necessary background to supply the context and relate a learning objective to another. It cannot be used to provide basic and deep knowledge as well as complex concepts because, according to its definition, it focuses on solving one problem or answering one question at a time. Smart learning is not appropriate for learning analytical skills or discovering cause and effect relationships because these activities usually require time for planning and reflection.

5- AUTHORS' CONTRIBUTIONS

Study conception or design: AP and MS; Data analyzing and draft manuscript preparation: MA, BM, and ND; Critical revision of the paper: AP; Supervision of the research: AP and MA; Final approval of the version to be published: AP, MA, BM, ND, and MS.

6- CONFLICT OF INTEREST: None.

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